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APPARATUS AND METHOD FOR VACUUMIZING CONTAINERS

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Fig. 1.

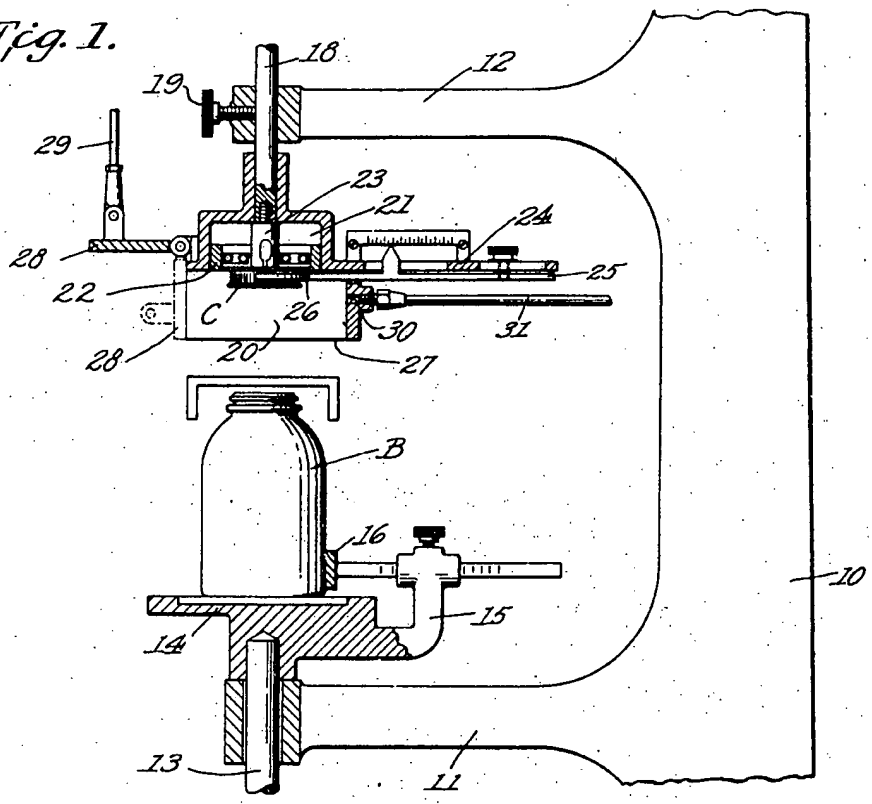


Fig. 2.

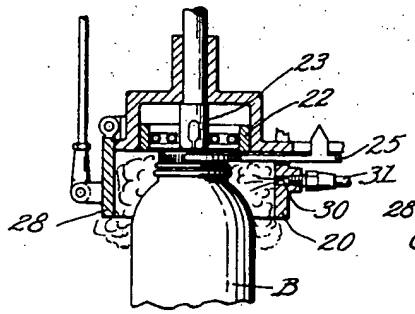


Fig. 3.

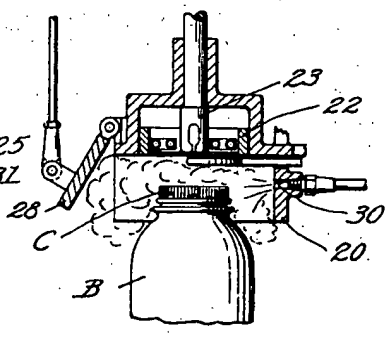
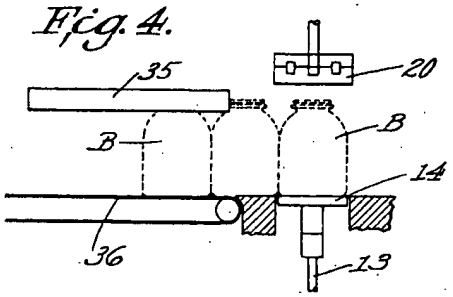


Fig. 4.



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APPARATUS AND METHOD FOR VACUUMIZING CONTAINERS

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15 Claims. (Cl. 226—82)

The present invention relates to apparatus and methods for vacuumizing containers.

Numerous methods and forms of apparatus have heretofore been developed to vacuumize containers by first filling the head space of the container with a heated fluid such as steam and immediately capping and cooling to condense the entrapped fluid so as to establish a low pressure condition within the capped head space. A serious disadvantage of most such methods employing steam has been that they have not avoided the possibility of the steam being or becoming moist at the time of its entry into the head space. Obviously, if the steam is too wet, large particles of water will be present in the head space when the steam is condensed.

The above difficulty usually arises because the chamber in which capping occurs either is not free from drafts of air, or is of such design that air cannot be sufficiently excluded therefrom at the time of capping. Naturally, if air cannot be excluded from the capping chamber the temperature of the steam will be lowered and it will become moist. Also, the steam placed in the container head space will be cooled if the cap and container mouth are cool at that time.

Another disadvantage of prior methods has been that condensation of entrapped steam has gradually occurred in an atmosphere containing a high proportion of air. It has been found that gradual condensation in air increases the probability of air reaching the head space before the cap is sealed to the container, thereby lowering the temperature of the head space steam, and resulting in free moisture and a less efficient vacuum. The above is true even where the cap is theoretically held in sealed position entirely by positive locking means, that is, where the containers and apparatus are of such type that the container is supposed to be held sealed by the locking means, alone, before any condensation of head space steam can occur.

Another disadvantage of prior methods has been that the apparatus required to perform such methods has been rather complicated, particularly if the presence of moisture is to be avoided in the container after condensation.

The principal object of the present invention is to provide a method and apparatus for vacuumizing containers which is of such nature that an extremely low pressure condition will be established within the head space of the container.

A further object of the invention is the provision of a method and apparatus for vacuumizing containers which are of such character that all possibility of moisture within the head space of the sealed container will be avoided.

Another object of the invention is the provision of a method of vacuumizing containers which is of extreme simplicity and which may be performed upon apparatus of corresponding simplicity.

Other objects and advantages of the invention will be apparent from the following specification and accompanying drawing, wherein:

Figure 1 is a side elevation, partly in vertical section, of an apparatus constructed in accordance with the present invention.

Figures 2 and 3 are fragmentary vertical sectional views, showing different stages in the operation of the Figure 1 apparatus, and

Figure 4 is a diagrammatic showing, partly in side elevation and partly in vertical section, of the apparatus illustrated in Figure 1.

The numeral 10 designates a vertical standard upon which an apparatus of the present invention may be mounted, the standard 10 including a lower arm 11 and an upper arm 12. The lower arm 11 is provided with a vertical bore at its outer portion in which a rod 13 is mounted for vertical reciprocation, the rod 13 having a container supporting platform 14 fixed to its upper end. Platform 14 may include a lateral and upward extension 15 in which a gauge 16 is slidably mounted. Gauge 16 is adapted to be secured at various points with regard to the vertical center line of platform 14 so as to bear against the lower portion of a container B to center the latter upon the platform. Gauge 16 may be held in an adjusted position by a set screw as indicated in Figure 1, and if the machine is of a type wherein containers are placed upon the platform by hand, the gauge will be sufficiently arcuate to partially extend about the container.

The upper arm 12 of the standard 10 is provided with a vertical bore at its outer end in which a rod 18 is mounted, rod 18 normally being held in fixed relation with respect to arm 12 by a set screw 19. Rod 18 has a housing or chamber 20 secured to its lower end, housing 20 including an upper portion 21 of reduced size in which a circular heating element 22 is secured, heating element 22 preferably comprising an electrical unit. A magnetic element 23 preferably of permanent type extends downwardly from rod 18 within the upper portion 21 of chamber 20 so as to be centrally arranged with respect to the heating element 22. Chamber 20 is also provided with a laterally extending arm 24 having a gauge rod 25 slidably mounted thereon. Gauge rod 25

is forked at its inner end to provide an arcuate portion 26 adapted to partially encircle a cap C and thereby center the cap with respect to the heating element 22 and magnetic element 23. The proper position of the gauge device 25 with respect to the vertical center line of chamber 20 will be indicated by the indexing device shown in Figure 1.

The lower portion of housing 20, when in closed position, will comprise four walls, three of which, designated by the numeral 27, are fixed, while the fourth wall 28 is pivoted as indicated to the upper portion 21 of the chamber. Wall 28 is adapted to be swung from the substantially horizontal position illustrated in full lines in Figure 1 to the vertical position indicated in dotted lines by means of any suitable mechanism, such as indicated at 29. When the wall 28 is in the vertical position it will, with the other three walls of the chamber, define a chamber enclosing the space immediately beneath the heating element 22.

One of the walls 27, preferably the wall directly opposite the pivoted wall 28, is provided with a port 30 to which extends a steam pipe 31 connected with a source of steam capable of delivering steam at a temperature of approximately 212°.

As best shown in Figure 4, a heating element 35 is positioned closely adjacent the chamber 20 and the container supporting platform 14. Heating element 35 is of inverted U-shaped form in cross section and is ordinarily provided with electrical heating elements of radiant type so positioned therein that they will heat the inner and outer surfaces of the container mouth and the upper surface of the container contents when the mouth of the container is within the heating element. Heating element 35 is therefore positioned at a suitable point above a table or endless conveyor 36 upon which containers stand prior to positioning upon the platform 14. In the apparatus diagrammatically illustrated in Figure 4, containers would be supported on the endless conveyor 36 for movement of their mouth portions through heating element 35 and will then be moved, as by pressure of following containers, upon the container supporting platform 14 for elevation in the chamber 20.

In the operation of the apparatus, a cap C will be positioned upon the lower side of the heating element 22, the cap being maintained in contact with element 22 by the magnetic element 23 and a container will be positioned beneath the heating element 35 for a sufficient period of time to cause its mouth portion, as well as the extreme upper portion of the contents to be heated to a temperature of approximately 212° F. The container will then be placed upon the container supporting platform 14, as indicated in Figure 1. Platform 14 will then be raised, preferably by continuous movement, to position the container mouth portion within the space defined by the walls 27 of chamber 20. As the container starts upward, steam will be jetted through port 30 to sweep air from chamber 20 and the pivoted wall 28 will be lowered to completely enclose the space within the chamber. By jetting steam into chamber 20 before wall 28 is lowered, the air will be driven therefrom, and when wall 28 drops, chamber 20 will enclose a steam atmosphere inaccessible to drafts.

The jet of steam continuing to issue from port 30 during the upward movement of the container will force all air from the container head space and when the mouth of the container comes in contact with the cap skirt, a body of steam will be entrapped within the head space of the container. Cap C will by this time have been heated to a temperature substantially above 212° F., for example, 250° to 350° F., by the heating element 22 and the entrapped steam will thereby be correspondingly heated to a greater extent than the surrounding steam within the chamber 20.

Upward movement of the container will terminate when the locking element upon the exterior of the mouth of the container has fully engaged the locking means upon the cap skirt so that the cap will be securely attached to the container mouth. In some instances the container and cap may be left in elevated position as indicated in Figure 2 for a short interval of time in order to further heat the steam entrapped within the container head space, the jetting of steam through port 30 being continued during this interval.

The platform 14 will then be lowered to move the container downwardly to draw the cap C away from the magnetic element 23 and the heating element 22. In any event, almost immediately the cap C is separated from the heating element 22, the steam within the head space of the container will be immediately and suddenly condensed due to the fact that the exterior of the cap is now surrounded by the relatively cooler steam being jetted at 212° through the port 30. A low pressure condition will thereby be created within the head space while the upper portion of the container is in an air excluding atmosphere so as to hold the cap in fully sealed position upon the container and prevent access of air to the head space either at that time or during the subsequent time when the cap and upper portion of the container will be further cooling to provide an even more rarified condition within the container head space. Such further cooling may be initiated by raising pivoted wall 28 very shortly after cap C has been moved out of contact with heating element 22, as shown in Figure 3, and after the highly heated steam in the head space has been condensed.

The present method and apparatus are particularly efficient due to the fact that condensation of the head space steam sufficient to cause the cap to be held firmly in sealing contact with the container occurs in a steam atmosphere, i. e., an air excluding atmosphere. As hereinbefore stated, by prior arrangements the condensation of head space steam has been performed either by air or by partially cooled steam which frequently permitted some air to reach the head space before sealing.

It is found that at the moment that the mouth of a container comes into initial sealing relationship with the skirt of a cap, the heat of the heating element 22 transmitted through cap C will cause the steam which has been placed within the container head space during the raising movement thereof to be instantaneously further heated and expanded so a portion of the steam within the head space will be forcibly and suddenly expelled past the skirt of the cap. In other words, at the time that a container finally has the cap sealed thereon, all of the steam enclosed within the head space of the container will be highly expanded and extremely dry steam.

It will be observed that the preheating element 35 heats the head space of a container to a sufficient extent that the steam issuing from

port 30 to subsequently contact with the upper portion of the container will not be condensed when it contacts with the container walls or contents. The possibility of water of condensation will thus be avoided so far as the container and its contents are concerned. Since the cap C is heated by heating element 22 prior to the jetting of steam against the cap, no water of condensation can form at any point upon the cap. Further, the presence of heating element 22 in the upper wall of housing 20 will keep that wall sufficiently heated to prevent condensation thereon. Obviously, condensate on this surface might drop into the container mouth.

The positioning of heating element 35 in a steam-free atmosphere is highly desirable, since it prevents moisture from condensing on the container. That is, if steam were present adjacent element 35, such steam would condense on each container before the container could be heated.

The degree of vacuum obtained by the present invention can be varied by reducing the temperature of heating element 22. By lowering this temperature the extent to which the steam entrapped in the container head space is superheated will be lowered and there will be less rarefication when the cap moves away from the heating element and the degree of vacuum in the head space will thereby be reduced.

If the apparatus is used to apply caps of the type provided with less positive locking means than those illustrated, i. e., caps adapted to be held in sealed position primarily by a low pressure condition in the container head space, the magnetic cap supporting element 23 may be of non-permanent type, so that it may be de-energized to permit release of the cap when the container moves into sealing position with respect to the cap.

It will be understood that in some instances, for example, when the containers to be sealed are still highly heated because of the fact that hot contents have just been placed within the containers, it is not necessary to provide the preheating element 35.

The invention is applicable either to a manually operated machine, or to an automatic machine including container delivery means as diagrammatically illustrated in Figure 4.

The terminology used in the specification is for the purpose of description and not of limitation, the scope of the invention being indicated in the claims.

We claim:

1. The method of vacuumizing containers comprising supporting a cap in a heated air-excluding atmosphere, heating the cap to a temperature above that of such atmosphere, applying the cap to a container so as to entrap a portion of such atmosphere in the container head space, and moving the cap from the cap heating source while maintaining it in such atmosphere so that the entrapped atmosphere will be condensed.

2. The method of vacuumizing containers comprising supporting a cap in a heated air-excluding atmosphere, heating the cap to a temperature above that of such atmosphere, applying the cap to a container so as to entrap a portion of such atmosphere in the container head space, and cooling the container head space while maintaining it in such atmosphere so that the entrapped atmosphere will be condensed.

3. The method of vacuumizing containers comprising heating at least the upper portion of a filled container in normal moisture-free atmosphere, directing a jet of steam into the head space of the container, heating a cap to a greater extent than the steam and applying it to the container, and causing the steam in the head space to condense.

4. The method of vacuumizing containers comprising heating at least the upper portion of a filled container, placing heated gaseous fluid in the head space of the container, heating a cap to a greater extent than the fluid and applying it to the container, and condensing the heated fluid.

5. The method of vacuumizing containers comprising supporting a heated cap in spaced relation to a container mouth, moving the two into contact in an air-excluding atmosphere while directing a jet of heated fluid between the cap and container mouth, and moving the cap while sealed to the container through a body of air-excluding fluid of less temperature than that which was originally applied to the cap.

6. The method of vacuumizing a container comprising heating a cap and applying the cap to a container in a cooler air-excluding atmosphere to entrap a portion of such atmosphere in the heated space of the container while the cap is still being heated, and condensing the entrapped atmosphere by means of the surrounding air-excluding atmosphere.

7. In an apparatus for vacuumizing containers, a container supporting element, a cap supporting element, one of said elements being movable with respect to the other, means within said housing to heat a cap supported therein, and means to direct a jet of heated fluid between a container and a cap during movement of the movable element.

8. In an apparatus for vacuumizing containers, a container supporting element, a housing element, means within said housing element to removably support a cap and heat the same, one of said elements being movable with respect to the other, and means to jet steam into said housing between a container and cap during movement of the movable element.

9. In an apparatus for vacuumizing containers, a container supporting element, a housing element, means within said housing element to magnetically support a cap and heat the same, one of said elements being movable with respect to the other, and means to jet steam into said housing between a container and cap during movement of the movable element.

10. In an apparatus for vacuumizing containers, radiant heating means, a container supporting element, means to move a container past said heating means and onto said container supporting means, a cap supporting element, one of said elements being movable with respect to the other, said cap supporting element including heating means, and means to direct a jet of heated fluid between a cap and a container during movement of the movable element.

11. In an apparatus for vacuumizing containers, a housing, a container supporting element movable toward said housing, said housing being open on its side facing said element, means to jet steam into the housing during approach movement of the container supporting element, and means in the upper portion of the housing to support and heat a cap.

12. In an apparatus for vacuumizing containers, a housing, a container supporting element movable toward said housing, said housing being open on its side facing said element, said housing

including a lateral port, gate means movable to close the port, means to jet steam into the housing during approach movement of the container supporting element, said means being positioned opposite the port, and means in the upper portion of the housing to support and heat a cap.

13. The method of vacuumizing containers comprising supporting a cap in a heated air-excluding atmosphere, heating the cap to a temperature above that of such atmosphere, applying the cap to a container so as to entrap a portion of such atmosphere in the container head space while continuing the application of heat to the cap so as to further raise the temperature of the atmosphere in the container head space, and moving the cap from the cap heating source while maintaining it in such atmosphere so that the entrapped atmosphere will be condensed.

14. The method of vacuumizing filled containers comprising applying dry heat, in a steam-free atmosphere, to at least the head space of the container and to a cap, positioning the cap and container head space in an atmosphere of steam maintained at such temperature that it will not condense on the head space or cap and causing the steam to enter the container head space, applying the cap to the container in the steam atmosphere, and cooling the container head space and cap to create a vacuum condition in the space defined thereby.

15. In an apparatus for vacuumizing containers, a steam chamber, a container conveyor including a portion in advance of said housing, a radiant heating element spaced above said conveyor beyond the steam atmosphere of said chamber to heat the upper portion of a container supported upon the conveyor while the latter is in normal atmosphere and prior to its entry into said chamber, means within the chamber to cooperate with the container to secure a cap thereto, and means to direct steam into the head space of the container prior to the application of a cap thereto.

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